THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims

1. (Original) An estimator for estimating a modulation index and frequency offset of a received continuous-phase-modulated (CPM) signal, the estimator comprising:

at least two filters for filtering the received CPM signal;

a calculator for calculating an α value and a β value;

a processor for receiving a signal output by each of the at least two filters, the α value, and the β value; and

wherein the processor is adapted to calculate estimates of the modulation index and frequency offset from the signals received by the processor and the received α value and β value.

2. (Original) The estimator of claim 1, further comprising a postprocessor for removing bias from the estimation of the modulation index.

3. (Original) The estimator of claim 2, wherein the postprocessor receives information relating to the frequency offset and manipulates the modulation index to form a compensated modulation index.

4. (Original) The estimator of claim 1, wherein the at least two filters are finite impulse response (FIR) filters.

5. (Original) The estimator of claim 1, wherein the estimator is implemented in a BLUETOOTH device.

6. (Original) A method of estimating a modulation index and frequency offset of a received continuous-phase-modulated (CPM) signal, the method comprising:

filtering the received CPM signal via at least two filters;

calculating an α value and a β value;

receiving a signal output by each of the at least two filters, the α value, and the β value; and

calculating estimates of the modulation index and frequency offset from the received signals and the received α value and β value.

7. (Original) The method of claim 6, further comprising removing bias from the estimation of the modulation index.

8. (Original) The method of claim 7, wherein the step of removing bias comprises receiving information relating to the frequency offset and manipulating the modulation index to form a compensated modulation index.

9. (Original) The method of claim 6, wherein the steps are performed in the order listed.

10. (Original) The method of claim 6, wherein the at least two filters are finite impulse response (FIR) filters.

11. (Original) The method of claim 6, wherein the method is implemented in a BLUETOOTH device.

12. (Original) An estimator for estimating a modulation index and frequency offset of a received continuous-phase-modulated (CPM) signal, the estimator comprising:

a noise whitener for whitening noise of the received CPM signal;

at least two filters for filtering the noise-whitened CPM signal;

an initializer for processing a training sequence;

a processor for receiving a signal output by each of the at least two filters and the processed training sequence; and

wherein the processor is adapted to calculate estimates of the modulation index and frequency offset from the signals received by the processor and the processed training sequence.

13. (Original) The estimator of claim 12, wherein the at least two filters are finite impulse response (FIR) filters.

14. (Original) The estimator of claim 12, wherein the estimator is implemented in a BLUETOOTH device.

15. (Original) The estimator of claim 12, wherein the noise whitener whitens the noise prior to the at least two filters.

16. (Original) The estimator of claim 12, wherein at least one of the at least two filters comprises the noise whitener.

17. (Original) A method of estimating a modulation index and frequency offset of a received continuous-phase-modulated (CPM) signal, the method comprising:

whitening noise of the received CPM signal;

filtering the noise-whitened CPM signal via at least two filters;

processing a training sequence;

receiving a signal output by each of the at least two filters and the processed training sequence; and

calculating estimates of the modulation index and frequency offset from the received signals and the processed training sequence.

18. (Original) The method of claim 17, wherein the steps are performed in the order listed.

19. (Original) The method of claim 17, wherein the at least two filters are finite impulse response (FIR) filters.

20. (Original) The method of claim 17, wherein the method is implemented in a BLUETOOTH device.

21. (Original) The method of claim 17, wherein the step of whitening is performed before the step of filtering.

22. (Original) The method of claim 17, wherein the step of whitening is performed by at least one of the at least two filters.

23. (Original) An estimator for estimating a modulation index and frequency offset of a received continuous-phase-modulated (CPM) signal, the estimator comprising:

at least two filters for filtering the received CPM signal;

a noise whitener for whitening noise of a signal output by the at least two filters;

an initializer for processing a training sequence;

a processor for receiving signals output by the noise whitener and the processed training sequence; and

wherein the processor is adapted to calculate an estimate of the modulation index and the frequency offset from the received signals and the processed training sequence.

24. (Original) An estimator for estimating a modulation index and frequency offset of a a received continuous-phase-modulated (CPM) signal, the estimator comprising:

a receiver for receiving the CPM signal; and

a processor for estimating the modulation index and frequency offset according to the following equation:

$$v = \left(B^T C^{-1} B\right)^{-1} B^T C^{-1} \phi$$

wherein v represents a vector;

wherein the vector includes elements representing scaled versions of estimates of the modulation index and the frequency offset;

wherein C represents a noise covariance matrix;

wherein B represents a data model matrix; and

wherein Φ is an observation vector that represents a phase of the CPM signal.

25. (Original) The estimator of claim 24, wherein the data model matrix is modeled by the following equation:

$$B = \begin{bmatrix} b_1 & 1 \\ b_2 & 1 \\ b_3 & 1 \\ \vdots & \vdots \\ b_N & 1 \end{bmatrix}$$

wherein $b_1, b_2, b_3, \ldots b_N$, represent bits of a training sequence.

26. (Original) The estimator of claim 24, wherein the data model matrix is modeled by the following equation:

$$B = \begin{bmatrix} b_2 & c_1 & 1 \\ b_3 & c_3 & 1 \\ b_4 & c_4 & 1 \\ \vdots & \vdots & \vdots \\ b_{N-1} & c_{N-1} & 1 \end{bmatrix}$$

wherein $b_2, b_3, b_4, \ldots b_{N-1}$, represent bits of a training sequence; and

wherein $c_2, c_3, c_4, \ldots c_{N-1}$, represent filter coefficients.

27. (Original) The estimator of claim 26, wherein a relationship between the bits of the training sequence and the filter coefficients is defined by the following equation:

$$c_k = (b_{k-1} - 2b_k + b_{k+1}).$$

28. (Original) The estimator of claim 24, wherein the data model matrix is modeled by the following equation:

$$B\begin{bmatrix} d_1 & 1 \\ d_2 & 1 \\ d_3 & 1 \\ \vdots & \vdots \\ d_{N-1} & 1 \end{bmatrix}$$

wherein $d_2, d_3, d_4, \ldots d_{N-1}$, represent filter coefficients.

29. (Original) The estimator of claim 28, wherein a relationship between the bits of the training sequence and the filter coefficients is defined by the following equation:

$$d_k = (\varepsilon b_{k-1} + (1-2\varepsilon)b_k + \varepsilon\, b_{k+1}),$$

wherein ε is a parameter indicating an amount of Inter-Symbol Interference present.

30. (Original) The estimator of claim 24, wherein the estimator is implemented in a BLUETOOTH device.